

Introducing a Simple Heat Treatment Method for Natural Topaz in Matale as an Alternative to the Irradiation

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Most of the Topaz found in Sri Lanka has low commercial value due to their yellow to colourless appearance. The pale colour Topaz can be converted in to blue by irradiation and it is stable at ambient or normal temperature and light. After the irradiation atoms become radioactive whenever there is an excess of energy in their nuclei. This radioactivity generates gamma radiation which can cause health problems for those who wear them. Therefore, some countries have issued acceptable radiation level for handling irradiated Topaz. However, Sri Lankan government's policies on the handling and distribution of radioactive irradiated Topaz to the public are still in infancy. This study is conducted to analyse the radioactivity of irradiated Topaz and to introduce a low cost simple harmless heat treatment method for colour enhancement of Topaz. Natural and irradiated Topaz of Polwatta was analyzed using gamma ray emission detector and radionuclides were identified using Gamma Spectrometry measurements. Mineralogical constituents and composition were confirmed by X-ray diffraction and Energy Dispersive X-ray Fluorescence. Natural topaz samples were subjected to heat treatment and exposure the treatment of temperature ranging 430 °C to 440 °C using electric furnace. Based on the results natural Topaz contained chromium (Cr) Thorium and Uranium series isotopes of ^{212}Pb , ^{214}Pb , ^{214}Bi , ^{228}Ac , ^{40}K and ^{208}Tl other than Al. After the irradiation process long lived radionuclides, ^{182}Ta , ^{88}Kr and ^{46}Sc were generated. Radioactivity of the irradiated samples is high with compared to the natural samples. The reported dose rate of irradiated Topaz was $107.34 \text{ mS v h}^{-1}$. It was able to obtain Pinky color by heat treatment of pale yellow Topaz. This was due to the presence of chromium in trace amount and it has been incorporated in to the crystal structure during the heating process in brown stones.

Keywords: Topaz, Thorium series, Uranium series, Heat treatment, Radioactive